- INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HACKER DAM
MADISON COUNTY, MONTANA
MT - 1276

PREPARED FOR:

HONORABLE TED SCHWINDEN

GOVERNOR, STATE OF MONTANA

AND

RICHARD L. HENDERSON

OWNER / OPERATOR

PREPARED BY:

Christian, Spring, Sielbach & Associates

Bozeman, Montana

Assisted By:

Northern Testing Labs, Inc.

Great Falls, Montana

January 1981

Seattle District

United States

Army Corps of Engineers

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EXECUTIVE SUMMARY

Under contract with the State of Montana, Department of Natural Resources and Conservation (MDNRC), and with representation from MDNRC, and the Hacker Dam owner, Christian, Spring, Sielbach & Associates, and Northern Testing Laboratories, Inc., inspected Hacker Dam (MT-1276) on July 20, 1980. The dam is located on Moores Creek in Madison County, three miles southwest of Ennis, Montana.

This memorandum for the record, was compiled from information obtained during the onsite investigation and very limited data obtained from the Soil Conservation Service.

FINDINGS

Hacker Dam is owned and operated by Richard Henderson, rancher, and is located on his private land. Principal use of the dam is for storage of irrigation water and private recreation.

The 34-foot high dam impounds an estimated 45 acre feet at the assumed dam crest elevation of 5194.9 feet MSL. On the basis of criteria in the U.S. Army Corps of Engineer's Recommended Guidelines for Safety Inspection of Dams (Ref. 1), the project is small in size.

The dam is listed in the National Dam Inventory as having a high (Category 1) downstream hazard potential. Based on visual reconnaissance during the inspection and subsequent analysis by the MDNRC, this classification is probably incorrect. It is our recommendation that the dam be re-classified as a low hazard structure. Inspection criteria (Ref. 1) recommend that a small-sized project with a low downstream hazard potential be capable of safely handling a flood in the range from the 50 to 100-year flood. The 100-year frequency flood event has a one percent chance of occurrence in any given year.

An estimated 100-year, 24-hour duration flood hydrograph was developed for the 27-square-mile drainage area. The resulting run off

volume was estimated at 1440 acre feet. Preliminary estimates of flood peaks associated with this event shows that flood peaks could be as high as 4050 c.f.s. The emergency spillway has a maximum discharge capacity of approximately 940 c.f.s. with the reservoir at dam crest. The dam would be overtopped with floods having a more frequent recurrence interval than the 100-year flood.

The dam is constructed of materials that would quickly erode and failure is likely to occur when overtopped with flood waters for a short period of time. The emergency spillway shows signs of frequent use and the small reservoir capacity is being reduced at a continually increasing rate by sediment entrapment.

A visual inspection of the embankment, and abutments revealed no serious irregularities, slumps, or settlements. Minor seepage was evident at the right abutment contact and high on the downstream slope. Repairs of the outlet conduit and replacement of embankment materials at the downstream toe have apparently been successful. The low-level outlet gate was inoperative and in a closed position at the time of inspection. Rock and boulders placed in the steep emergency spillway exit channel to repair previous erosion damage, appear to be susceptible to scour and movement with possible high flows. Emergency spillway flows could impinge on and erode the downstream toe of the embankment at the abutment contact. Based on our visual inspection, the embankment appears to be marginally stable at the present time, however, there is no information on how the embankment was constructed, strength characteristics of embankment materials or position of the phreatic surface from which a stability assessment can be made.

RECOMMENDATIONS

Because of the low downstream hazard potential of Hacker Dam, the complete Phase I investigation report required by the Recommended Guidelines (Ref. 1) was not prepared. Instead, general recommendations are to more fully evaluate the downstream hazard potential, taking into consideration future development. Conduct more detailed hydrologic and hydraulic

studies to better determine the required discharge capacity commensurate with the downstream risk. Modify the project as studies indicate. Periodically monitor seepage in the downstream embankment and foundation to detect conditions which may threaten the safety of the project. Inspect the dam during and after flood events causing emergency spillway flows to detect potential damaging erosion and unstable conditions. Immediately repair as conditions warrant.

Bob B. Gemmell

Professional Engineer

HACKER DAM
PERTINENT DATA

1. General

Federal I.D. No.	MT-1276
Owner/Operator	Richard L. Henderson
Date Constructed	1953
Purpose	Irrigation
Location	SE ¼, Sec. 6, T6S, R1W, MPM About 3 miles southwest of Ennis, Montana by road
Watershed	Moore's Creek
Size Classification	Small
Downstream Hazard Potential	Category 3, (low)
USGS Quadrangle	Virginia City

2. Reservoir

Surface area at Normal Pool Elevation 5188.6 feet MSL	2.0 acres (estimated)
Storage at Normal Pool	30 acre-feet (estimated)
Surcharge Storage At Dam Crest Elevation 5194.9 feet MSL	15 acre-feet (estimated)
Storage at Dam Crest	45 acre-feet (estimated)
Drainage Area	27 square miles

3. Emergency Spillway

Type	Uncontrolled, unlined earth (rock riprap in downstream channel)
Crest Elevation	5189.2 feet MSL
Length of Crest (bottom width)	20 ft.
Spillway Capacity, Reservoir at dam crest el. 5194.9 feet MSL	940 cfs (estimated)

HACKER DAM

PERTINENT DATA

4. Principal Spillway	
Type	Uncontrolled Concrete Drop Inlet
Crest Elevation	5188.4 feet MSL
Dimensions	37-inch X 37-inch (inlet) Tapers to
Riser	24-inch-diameter CMP
Riser Height	20 to 25 feet
Discharge Conduit	85 feet of 24-inch-diameter CMP
Capacity with reservoir at Dam Crest el. 5194.9 feet MSL	55 cfs (estimated)
5. Outlet Works	
Conduit Description	12-inch-dia. CMP to 24-inch-dia. CMP
Conduit Length	Approximately 65 feet
Control	12 inch slide gate at inlet
Capacity at Dam Crest	10 cfs (estimated)
6. Dam	
Type	Earth fill
Hydraulic height (crest to toe)	34 ft.
Dam Crest Elevation	5194.9
Crest Length	330 ft.
Crest Width	10 feet
Upstream Slope	1V on 2.5H
Downstream Slope	1V on 2.0H

MEMORANDUM FOR THE RECORD

To: The Record

From: Bob Gemmell, Engineer, Team Leader
Rob Gillespie, Geotechnical Engineer

Date: September 1, 1980

Subject: Hacker Dam (MT-1276) Field Inspection

INSPECTION

Personnel of Christian, Spring, Sielbach & Associates and Northern Testing Laboratories, Inc., subcontractor, along with representation from the State of Montana Department of Natural Resources and Conservation, inspected Hacker Dam (MT-1276) on July 20, 1980. The dam is located in Madison County, Montana, Section 6, T6S, R1W, MPM, about 3 miles southwest of Ennis, Montana. The dam is owned and operated by Richard L. Henderson for storage of irrigation water.

According to criteria in the U.S. Army Corps of Engineers Recommended Guidelines for Safety Inspection of Dams (Ref. 1), the project is small in size. Prior to the inspection, there was some question about the downstream hazard posed by this dam. It is presently classified as high (Category 1). During the inspection a reconnaissance of the area downstream from the dam was made. It was observed that failure of the dam would cause little damage. Therefore, it should be re-classified as having a low (Category 3) downstream hazard potential. Inspection criteria recommend that a small sized project with a low downstream hazard potential be capable of safely handling a flood in the range from the 50 to the 100-year flood. A preliminary estimate of the 100-year, 24-hour flood shows that the dam would be overtopped during a flood event with a more frequent recurrence interval than the 100-year flood. No flood routing was made, however, conclusions on overtopping are based on the small surcharge storage available in the reservoir (15 acre-feet) as compared to

the flood volume (1440 acre feet) produced by the 100-year, 24-hour flood event and inadequate spillway capacity to safely pass the flood peak associated with this flood event. This report recommends further study to better evaluate the downstream hazard and to better determine the spillway design flood.

Those present during the inspection included:

Bob B. Gemmell	-	CSSA-Senior Water Resources Engineer and Team Leader
Les Crawford	-	CSSA-Civil Engineer
Rob Gillespie	-	NTL-Senior Geotechnical Engineer
Bill Henning	-	NTL-Geologist
Gary Quinn	-	NTL-Geotechnical Engineer
Art Taylor	-	State of Montana Department of Natural Resources and Conservation
Richard Henderson	-	Owner/Operator

Because of low downstream hazard potential of Hacker Dam, the normal complete Phase I inspection report was not prepared. Instead, information gathered from a review of available data and the field inspection is presented in this memorandum for the record. This report was reviewed by Montana DNR & C and the owner. Their responses are included in the Appendix.

DESCRIPTION OF THE PROJECT

Hacker Dam is located in the southern part of Madison County, Montana, approximately 3 miles southwest of Ennis, Montana, by road. (Plate 1) The reservoir is fed by Moores Creek which is a tributary of the Madison River. (Plate 2) According to the Recommended Guidelines for Safety Inspections of Dams by the U.S. Army Corps of Engineers, this dam is classified as small in size. The federal identification number is MT-1276.

The 34-foot-high dam impounds an estimated 45 acre-feet at dam crest, assumed elevation 5194.9 feet MSL. The 2.0 acre reservoir is used

for irrigation and private recreation. The drainage area is 27 square miles.

The project has an uncontrolled earth emergency spillway located on the left abutment. A 12-inch-diameter CMP conduit with a 12-inch slide gate control at the reservoir entrance serves as the low level outlet works. The 12-inch-diameter conduit discharges into the bottom of a 24-inch-diameter vertical riser which serves as the principal spillway. A 24-inch-diameter conduit through the embankment from the riser pipe discharges both low-level outlet releases and uncontrolled principal spillway flows. (Plate 5)

REGIONAL GEOLOGY

"The foothills and mountains in this region are largely underlain by ancient gneiss and schist, overlapped by folded and faulted Paleozoic and Mesozic sedimentary rocks. Narrow northwest-trending belts of these sedimentary rocks lie within these metamorphic rocks. These belts are bounded largely on the northeast by steep faults. Intruded into these rocks are granitic rocks of the Idaho and Boulder batholiths and outlying intrusives. Tertiary volcanic rocks overlie old eroded surfaces in many places, particularly in and near Yellowstone Park. The volcanic rocks range in age from Eocene to upper Miocene and later, and have undergone uplift, some deformation, and faulting in the orogenic movements that produced the mountain ranges. During the Wisconsin and earlier stages of glaciation there was probably an extensive ice cap covering most, possibly all of the Yellowstone Park Plateau and Absaroka Range and Beartooth Mountains to the north and northeast. Farther north, northwest, and west, between the Park and the Idaho-Montana line, there were many local glaciers, some of them large, heading in the cirques that scallop the upper slopes of the highest mountain ranges both east and west of the divide. During Wisconsin and Post-Wisconsin time, numerous gravelly terraces were deposited, possibly marking minor substages of cutting downward and incipient lateral planation. Some of the terrace gravels may be composed of outwash from mountain glaciers." (Ref. 2)

SEISMICITY

The Madison Range lies within a seismic zone of major seismic activity. For a recurrence interval of 50 years, there is a 0.90 probability that earthquakes of Richter Magnitude 6.5 to 7.5 with associated bedrock accelerations of 0.2 to 0.49 will not be exceeded. According to Corps of Engineers guidelines, the damsite is within Seismic Zone 3 and has a recommended seismic coefficient of 0.10.

The Madison Range Fault, a major active fault, lies approximately eight miles east of the site. The fault roughly parallels the Madison River before turning in a northwesterly direction and losing its trace to the north of the site. This fault is a high-angle normal type with the west side downthrown. The most recent movement along much of the fault is late Quatenary in age, although some references site more recent historic activity.

Major seismic events surround the damsite with the greatest concentrations being to the south and east. The dam has withstood the areal effects of the 1959 Hebgen Lake earthquake, Richter Magnitude (RM) 7.1. The greatest event recorded in the immediate damsite area was on the order of RM 3 to 4.

SITE GEOLOGY

The dam has been constructed in a narrow valley, formed by down cutting of Moores Creek through the cobble and gravel terrace deposits. (Photo 1) Down-cutting proceeded until Precambrain bedrock was encountered at the left abutment (Photo 2 - background). The creek subsequently began to follow this bedrock contact; the valley then begins to fan and widen out just downstream from the dam. The dam abuts two different types of material. The left abutment is Precambrain gniess, schists, and quartzite. These rocks are very decomposed and weathered. The rocks strike approximately parallel to the dam and dip downstream at about 70^{o}. The quartzite beds form distinctive units that are approximately 6 inches to 2 feet thick and are interbedded throughout the exposure. The right abutment of the dam is a heterogeneous deposit of Pleistocene cobbles and coarse sand and gravel. (Plate 3)

DESIGN AND CONSTRUCTION HISTORY

This dam was constructed in 1953 by the original owner Parm Hacker, with the assistance of the SCS. There are no plans, specifications, design or construction records available for the original construction.

The dam was inspected by the Soil Conservation Service in 1976 at the request of the owner. The inspection found the corrugated metal outlet conduit of the principal spillway to be badly damaged at the downstream toe. Apparently, leakage and/or underflow had undermined the embankment toe at this location resulting in a slide involving approximately 350 cubic yards of material. Inspection notes by the Soil Conservation Service indicated that slide repair was made with a gravelly material tamped in place by a backhoe. A concrete cutoff collar was reportedly installed in conjunction with outlet conduit replacement, and riprap was placed along the downstream toe to improve stability and minimize outlet channel erosion.

DAM EMBANKMENT

The earthfill dam was built in 1953 under design and construction guidance of the Soil Conservation Service. The earthfill material was probably borrowed from the Pleistocene sand-gravel terrace deposits at the damsite. This material is highly erodible, and failure would likely occur if the dam were overtopped for a short period of time.

The embankment is 330-feet-long, 34-feet high, and has a crest width of 10-feet. The upstream and downstream slopes are 1V on 2.5H and 1V on 2.0H, respectively.

The inspection found no irregularities or other indications of settlement along the embankment crest. There was no differential movement observed at either abutment, although seepage was evident at the right abutment contact, and high on the downstream slope.

The upstream slope was generally well vegetated with grasses and sagebrush. No other slope protection was apparent. (Photo 3) Wave erosion of minor consequence was noted.

The downstream slope had a heavy grass and sage brush cover except in the area of the above mentioned repair.(Photo 3) Minor evidence of animal traffic and rodent burrowing was observed. Seepage observed near the right abutment was traced in a northerly direction across the slope face approaching the area repaired in 1976. Some small seeps were noted in the area of the left abutment.

There is no instrumentation installed in the dam embankment.

FOUNDATION CONDITIONS, SEEPAGE AND DRAINAGE

The dam crosses a narrow valley carved into glacio-fluvial terrace deposits until a contact with Precambrian bedrock was reached at the present left abutment. Foundation soils, as can be inferred by inspection of adjacent sidehill erosion features, are a sand-gravel-cobble mixture.

Seepage was readily visible at the right abutment contact. Attributing this seepage entirely to dam leakage is doubtful since considerable sidehill seepage was observed downstream from the contact. Embankment leakage is evidenced, however, by seepage on the downstream face north of the left abutment at elevations above the sidehill seeps. Minor seeps in the downstream toe area near the right abutment were observed.

The areas around the principal spillway conduit and approaching the emergency spillway channel were covered with riprap, (Photo 4). The emergency spillway exit channel has apparently experienced erosion in the past. Large diameter rock has been placed in the exit channel bottom to prevent scour erosion that could be caused by frequent use of the emergency spillway. (Plate 4) The effectiveness of the loose rock riprap under high flow conditions would be questionable. (Photo 4)

STABILITY

The repairs initiated as a result of the 1976 Soil Conservation Service inspection have apparently been successful. No visible evidence of insta-

bility in the repaired area of the downstream slope was noted. The seepage observed near the left abutment and at the left abutment contact is probably not a problem of recent origin and does not appear to have had any effect on stability. Although localized seepage was noted on the downstream slope, it appears that this seepage does not constitute an immediate threat to embankment stability. The project was subjected to significant seismic loading during the 1959 earthquake with no reportedly visible damage to the embankment. Based on our visual inspection and engineering judgment, the embankment appears to be marginally stable. However, insufficient information on embankment material characteristics and location of the phreatic surface is available to adequately assess stability.

EMERGENCY SPILLWAY

The uncontrolled earth and rock lined emergency spillway is 20 feet wide, 85 feet long and has a crest elevation 5189.2 feet MSL. Side slopes are about 1V to 2H. There is a 30-foot long approach section with a 2% adverse slope followed by an 85-foot long section with a 1.5% favorable slope. (Plate 4) Water flows drop 3 to 4 feet over a ledge at the end of the 85-foot long section to enter a steep exit channel which terminates near the downstream toe of the dam at the left abutment contact. The steep exit channel has seriously eroded in the past and presently has the bottom covered with large boulders for protection. (Photo 4) The boulder size riprap is subject to possible scour and removal during high spillway discharges. The spillway shows signs of operating almost every year, and therefore has a high potential for erosion damage. The maximum discharge capacity of the spillway with the reservoir at dam crest was estimated to be 940 c.f.s. The discharge rating for the emergency spillway was developed by assuming critical depth computing backwater effects (head losses) in the approach channel.

OUTLET WORKS/PRINCIPAL SPILLWAY

The outlet works and principal spillway are combined into a single unit located near the center of the dam. (Plate 5) The principal spillway is uncontrolled, and has a 37" X 37" inside-diameter monolithic concrete

inlet resting on top of a 24-inch-diameter corrugated metal pipe riser. The crest elevation of the principal spillway is at assumed elevation 5188.4 feet MSL. The riser connects to a 24-inch-diameter CMP outlet which extends through the embankment, and serves as a common outlet for the controlled low-level outlet pipe and the principal spillway. The low level outlet is a 12-inch-diameter corrugated metal pipe which extends from reservoir inlet to the bottom of the principal spillway riser. A 12-inch-diameter sluice gate controls the inlet, with a hand wheel lift and lift base located near the upstream shoulder of the dam crest. The gate operating rod (gate stem) is located on the upstream face of the embankment dam.

Because of its limited capacity, the uncontrolled principal spillway serves primarily as a low-flow discharge facility to prevent long duration flows in the emergency spillway. It would have little effect on flood routing since its crest elevation is less than 1 foot below the emergency spillway crest. Normal pool elevations are maintained near the principal spillway crest elevation, unless irrigation releases are made. The maximum discharge of the principal spillway with the reservoir at the emergency spillway crest is estimated at 36 c.f.s., with weir flow controlling.

The maximum discharge of the principal spillway is estimated to be 55 cfs with the reservoir level at dam crest elevation 5194.9 feet MSL. A Mannings "n" of 0.025 was used to estimate friction losses with the conduit flowing full.

The field fabricated trash screen on the principal spillway is inadequate to insure operability. The gate on the low-level outlet was reported as inoperable at the time of investigation. Due to the small size of the conduit and a small flow over the principal spillway crest the pipe was not inspected. There is no means to control principal spillway discharge in the event of an emergency.

FREEBOARD

The vertical distance between the principal spillway and the dam crest is 5.7 feet. The effective fetch distance for wind-generated waves, is approximately 500 feet with wave runup estimated at less than 1.5 feet, therefore the vertical distance between the dam crest and normal pool elevations is adequate to prevent overtopping of the embankment by wind waves. Since it is estimated the dam will overtop by floods of more frequent occurrences than the 100-year event, the project has no freeboard.

HYDROLOGY

The drainage basin area is approximately 27.0 square miles, triangular in shape with the longest dimension running north-south. The north end of the drainage is part of the Tobacco Root Mountains in the Beaverhead National Forest. Most of the basin is steep to very steep with the north end primarily forested. The elevations range from approximately 5200 feet MSL at the dam to over 7600 feet MSL at the highest point. Moores Creek flows in a south-easterly direction with a length of approximately 7.0 miles from the top of the drainage to the dam.

The 100-year precipitation expected has a value of 1.6 inches for a 6-hour event, and 2.6 inches for a 24-hour event as determined from the NOAA ATLAS 2 for Montana (Ref. 3). The 100-year, 6-hour event produces approximately 1150 acre feet of water and the 24-hour event 1440 acre-feet, as determined by procedures outlined in the SCS Engineering Field Manual, Chapter 2, Supplement 1, "Estimating Runoff in Montana." The estimated peak flow produced by the 100-year, 24-hour flood event is 4050 c.f.s. at the dam site.

OPERATIONS AND MAINTENANCE

The only record of maintenance is the repair of approximately 30 feet of the downstream end of the outlet conduit in 1976. The cause of the damage is unknown, but the repair of the 24-inch CMP and adjacent embankment was accomplished by the owner with technical assistance provided by SCS. The record shows the following work was performed:

- installation of 32' of asphalt treated 24-inch CMP with connecting bands.
- construction of a concrete collar around the connecting bands requiring 1.42 CY of concrete
- placement of 350 cubic yards of gravel back fill.
- placement of 50.0 cubic yards of rock riprap.

Sediment accumulation in the reservoir is proceeding at a rapid rate. The large drainage area (27.0 square miles) contributing to this small reservoir will continue to reduce water storage capacity significantly in the future.

SIZE AND DOWNSTREAM HAZARD POTENTIAL

The height of the dam is 34 feet and the maximum storage is about 45 acre-feet at dam crest. The dam is classified as small in size. During the inspection a question was raised as to the classification of the downstream hazard potential, presently classified as high (Category 1). Due to the small reservoir capacity and length, a sudden dam break flood wave would not be sustained at the breach, and would be attenuated rapidly on the flood plain below the dam. A very preliminary dam breach analysis and routing performed by Glen McDonald, of the MDNRC, showed that water depths in an area of light housing about 2¼ miles downstream would be less than 1 foot and flow velocities would be very low. The raised road bed on Montana Highway 287, which is 2 miles downstream, is transverse to the direction of flow and would further attenuate the 45 acre feet or water released by a sudden breach of the dam. Based on a brief field reconnaissance, and the preliminary results of the dam breach analysis as performed by the MDNRC, it is our recommendation that the dam be re-classified as a low hazard structure.

FINDINGS AND RECOMMENDATIONS

Because of small surcharge storage capacity, Hacker Dam provides very little or no flood protection. Annual runoff events are released through the emergency spillway with no attenuation. The natural sediment

production of the 27-square-mile drainage is rapidly reducing the useable reservoir storage capacity. Project recommendations are listed below:

1. Conduct more detailed hydrologic and hydraulic routing studies to better determine the downstream hazard and required spillway capacity, and modify the project as studies indicate.

2. Inspect the entire length of principal spillway and low-level outlet conduit, and repair as required. Provide means for closure of the principal spillway in the event of an emergency.

3. Periodically test the operation of the outlet gate to prevent "freezing" on the slide contact.

4. Replace the trash rack on the principal spillway riser with a durable and functional structure.

5. Inspect the project during and after flood events to determine conditions that may effect the safety of the dam, with particular attention to erosion conditions in the emergency spillway exit channel and downstream embankment toe. Make immediate repairs as required.

6. Continue to monitor localized seepage observed high on the embankment and at the abutment contact. Should seepage show signs of increasing with accompanying material movement at the embankment exit, take immediate steps to drawdown the reservoir. Conduct engineering studies to design modifications to correct observed conditions. These studies should be conducted by a geotechnical engineer experienced in earth dam design and construction. Modify the project as studies indicate.

REFERENCES

1. U.S. Army Corps of Engineers, Office of the Chief of Engineers Report to the U.S. Congress, National Program of Inspection of Dams, Vol. 1, Appendix D, "Recommended Guidelines for Safety Inspection of Dams," Washington, D.C., Dept. of the Army, May 1975.

2. "Physiography and Glacial Geology of Western Montana and Adjacent Areas" by William C. Alden, Geological Survey Paper 231, 1953.

3. National Oceanic and Atmospheric Administration (NOAA) Atlas 2, Precipitation - Frequency Atlas of the Western U.S., Vol. 1 Montana, 1973.

PHOTO 1

Reservoir Area

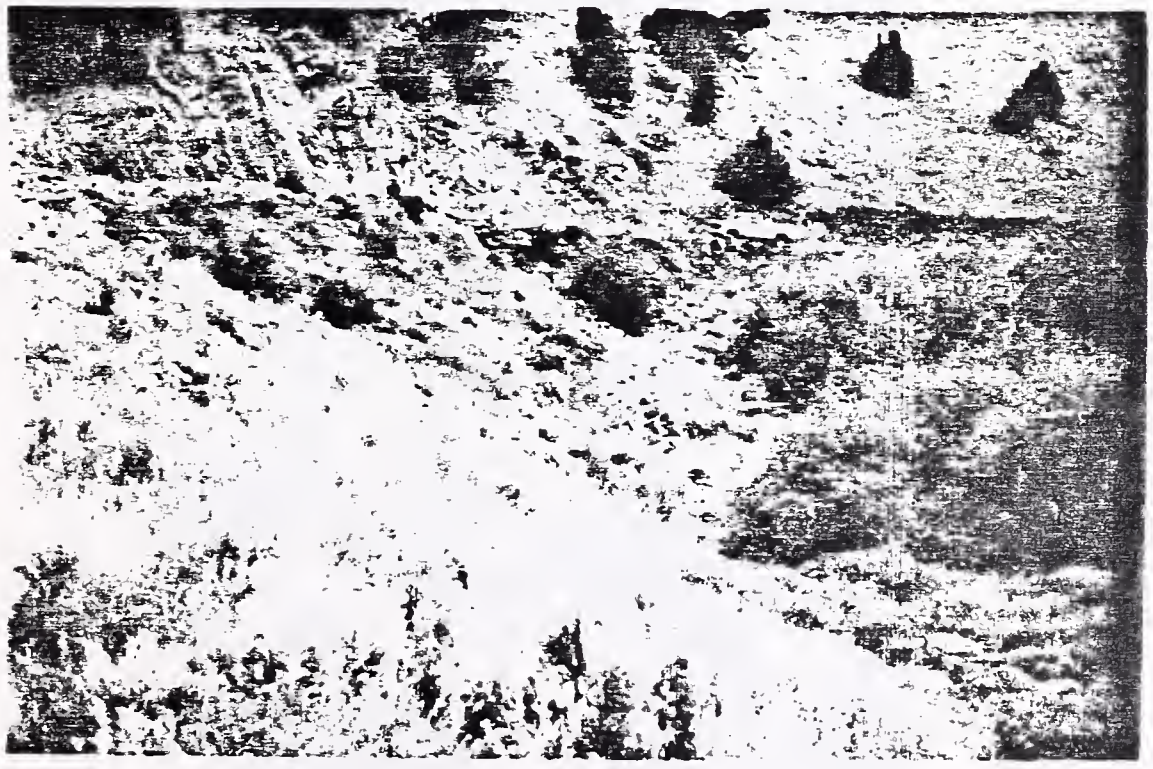


PHOTO 2

Downstream Face of Dam

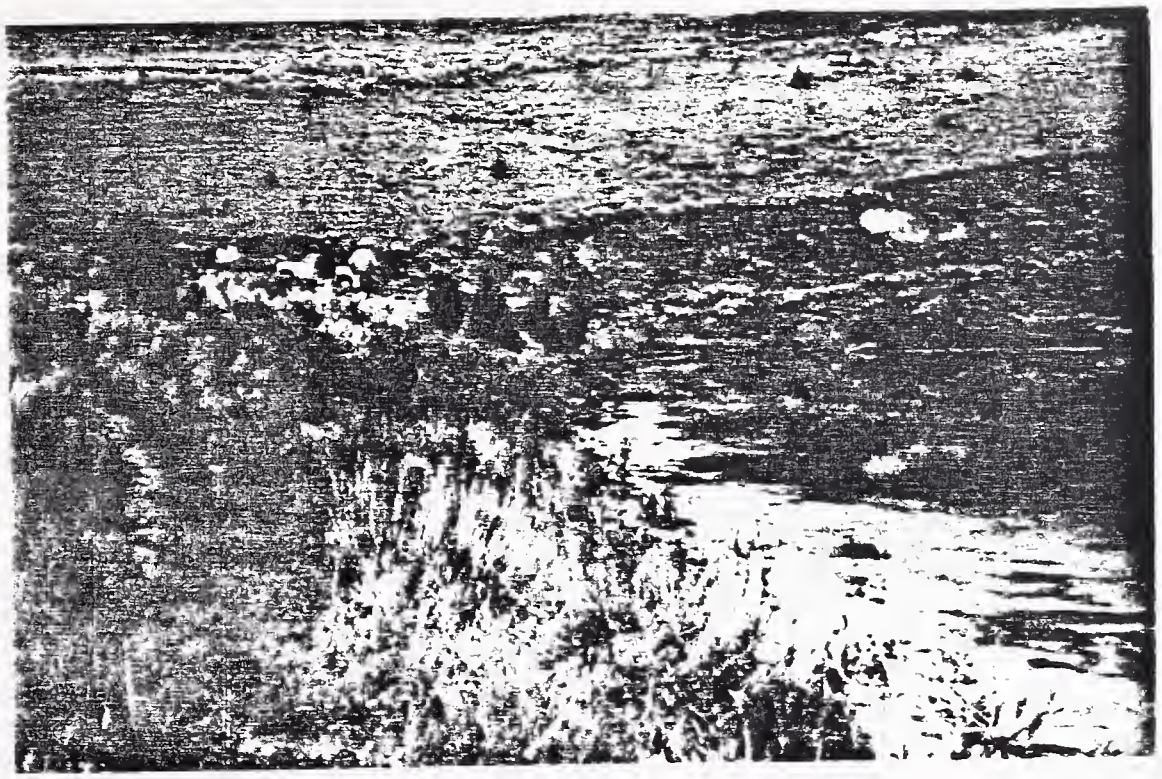


PHOTO 3

Upstream Face of Dam

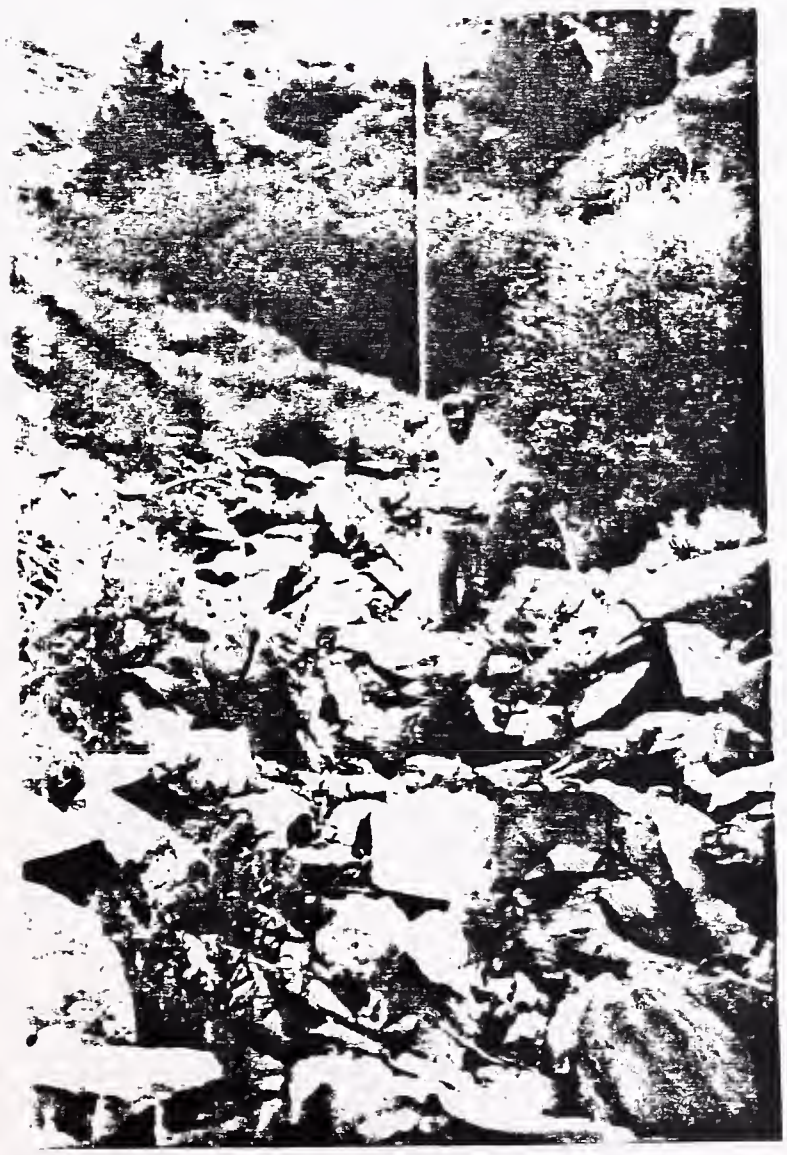


PHOTO 4

Emergency Spillway Looking Downstream

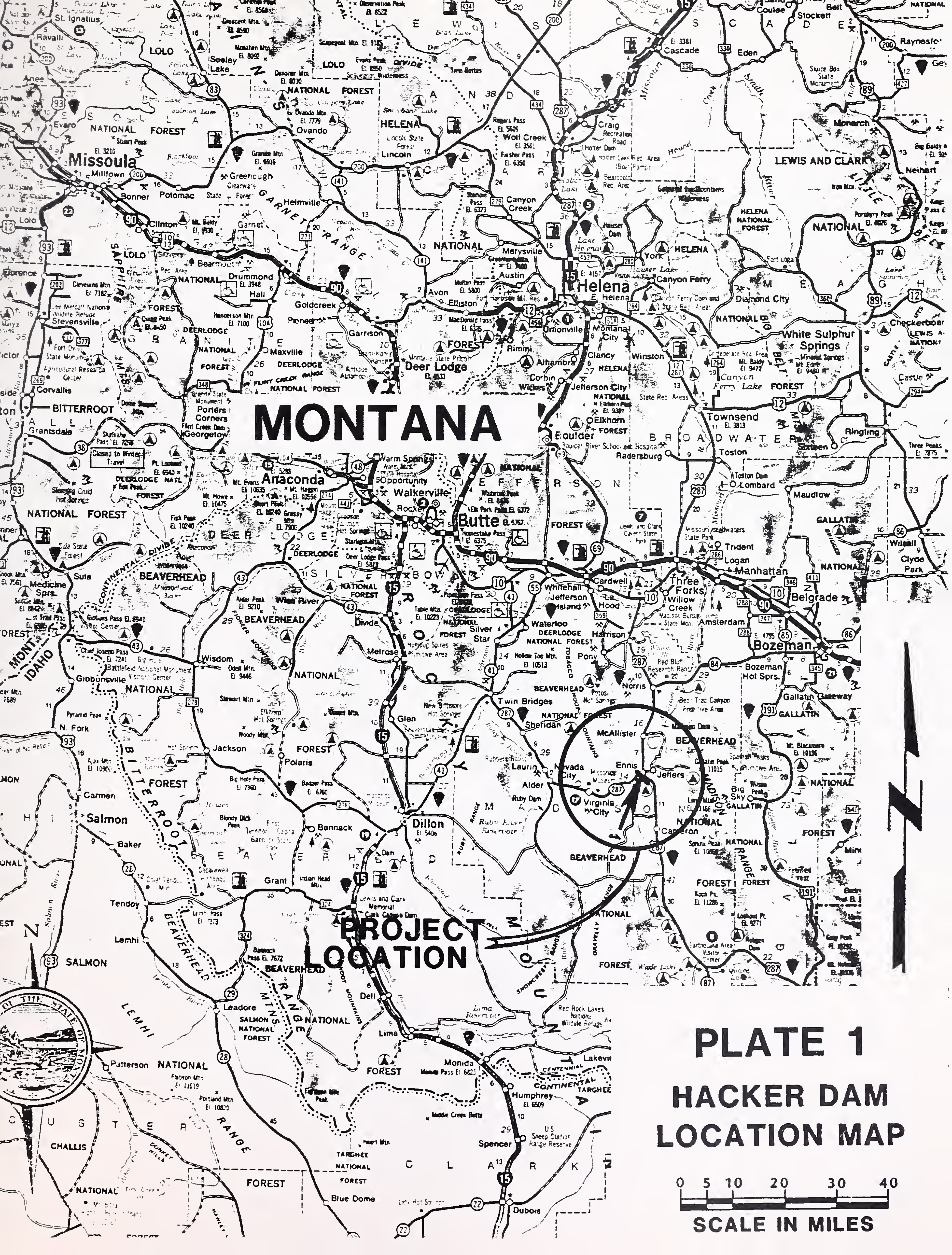


PLATE 1

HACKER DAM LOCATION MAP

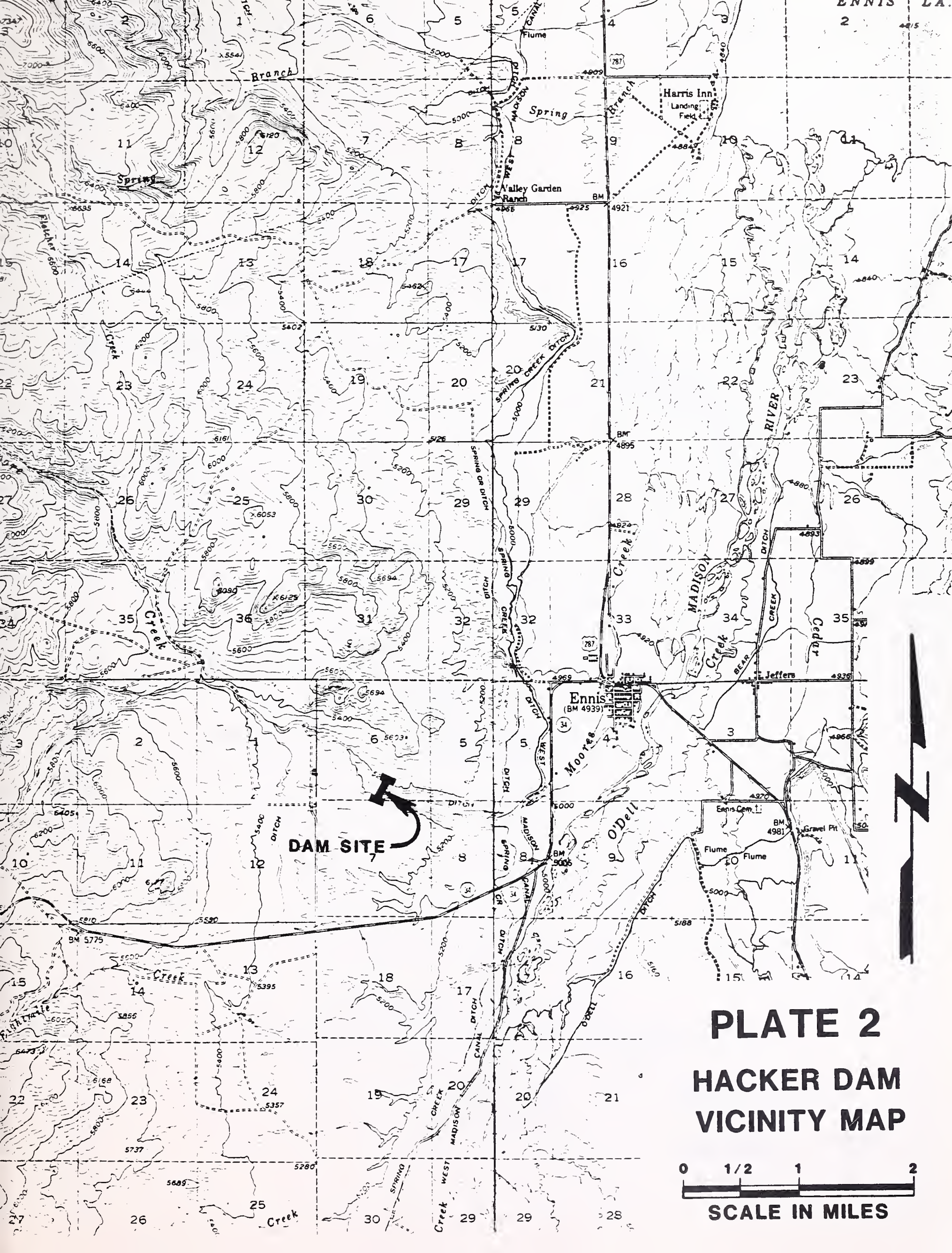
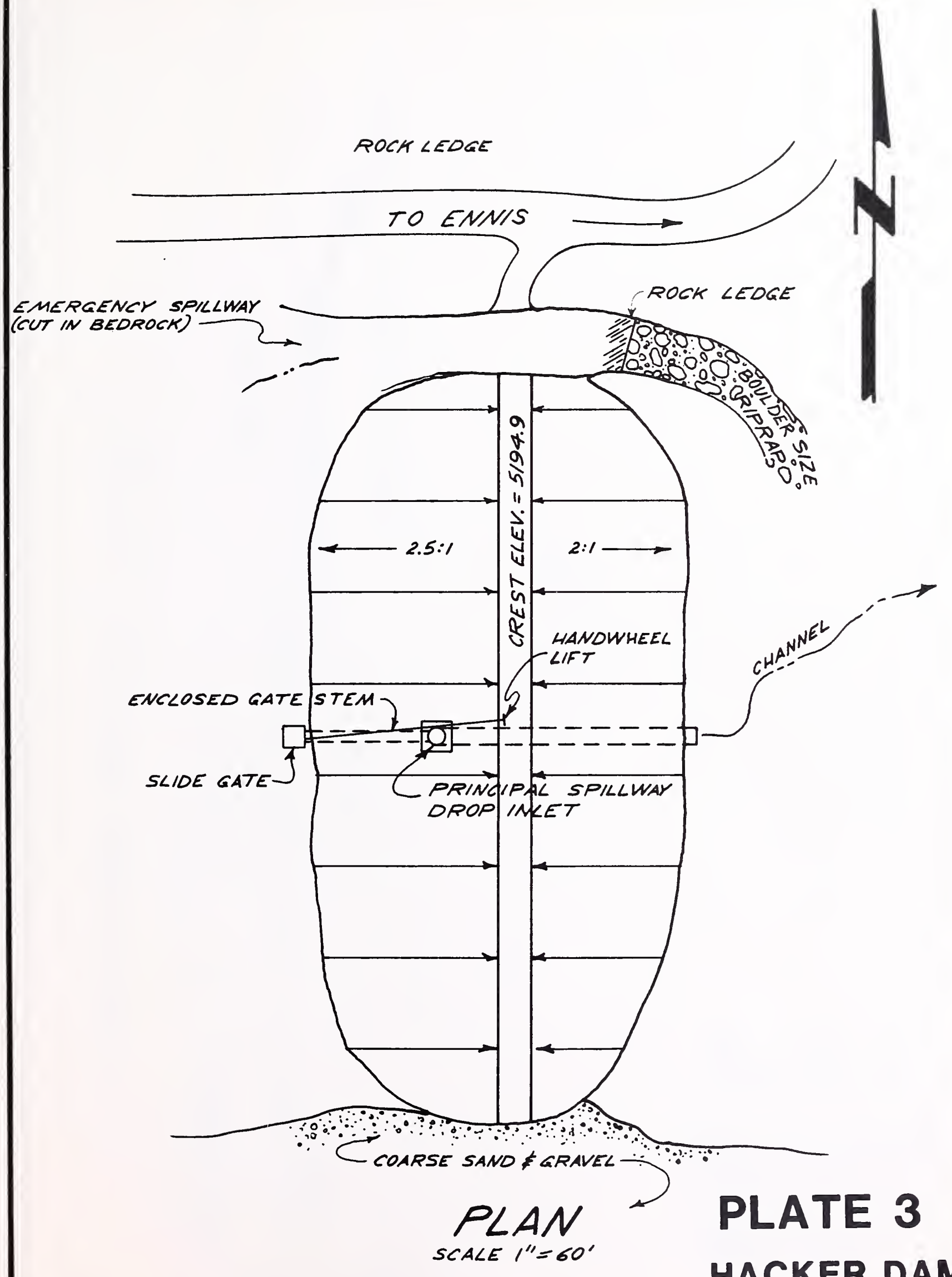


PLATE 2

HACKER DAM VICINITY MAP

0 1/2 1 2

SCALE IN MILES

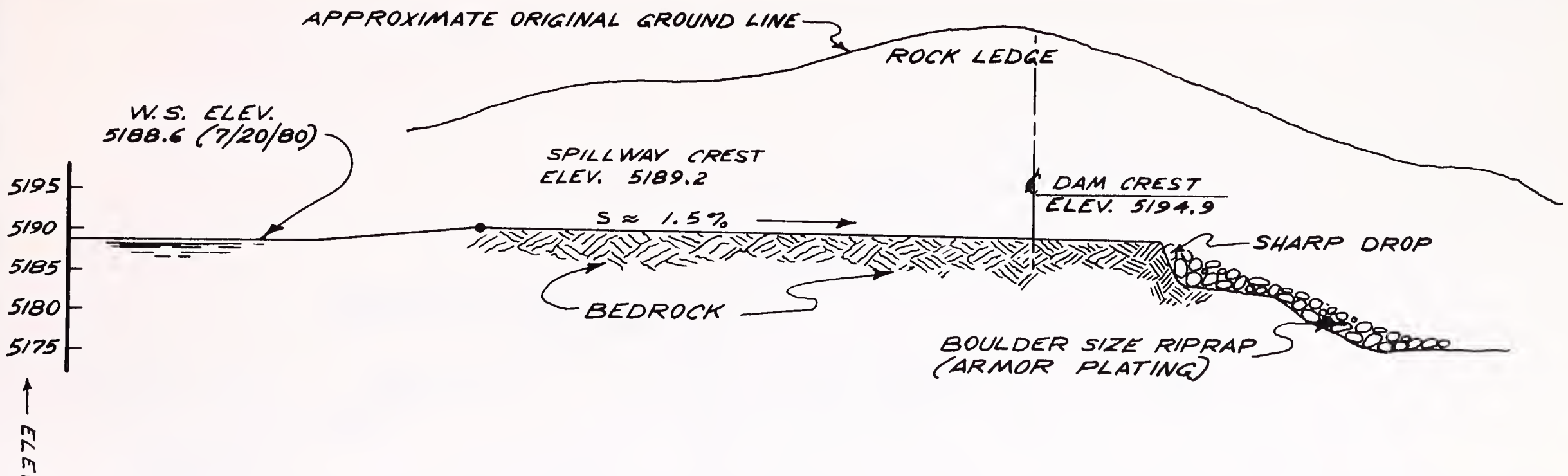


PLAN

SCALE 1"=60'

PLATE 3

HACKER DAM SITE PLAN



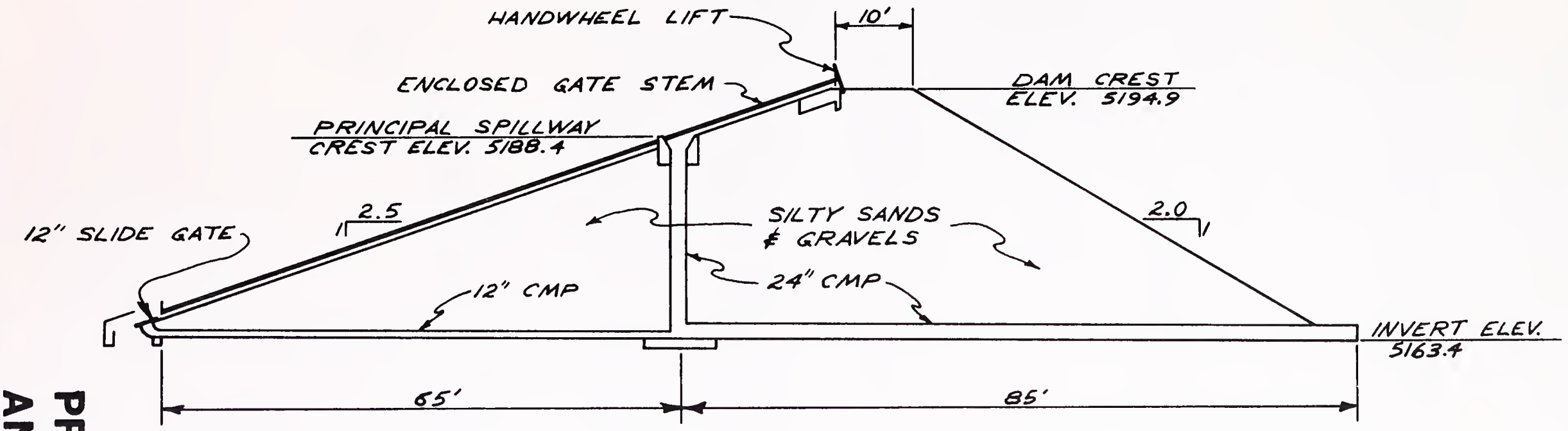
PROFILE

SCALE 1"=20'

PLATE 4

HACKER DAM

EMERGENCY SPILLWAY



SECTION ON ℄

SCALE 1"=20'

PLATE 5

HACKER DAM

PRINCIPAL SPILLWAY

AND OUTLET WORKS

DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION
WATER RESOURCES DIVISION

THOMAS L. JUDGE, GOVERNOR

32 SOUTH EWING

STATE OF MONTANA

(406) 449-2872

HELENA MONTANA 59601

December 18, 1980

Department of the Army
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Attn: Ralph Morrison

Re: Christian, Spring, Sielbach and Associates Dam Safety Report on Hacker Dam (MT-1276).

Dear Ralph:

We have reviewed the above referenced draft report. We concur with the findings and recommendations and find that it satisfies the criteria of the Meomorandum-for-the-Record.

Mr. Richard L. Henderson's comments are attached.

Thank you for this opportunity to review and comment on the draft report on Hacker Dam.

Sincerely,

Arthur D. Taylor

Arthur D. Taylor
Dam Safety Engineer
Engineering Bureau
(406) 449-2864

AT:lj

JONES & GAA
ATTORNEYS AT LAW
Wallace and Broadway
Post Office Box 337
Virginia City, Montana 59755

(406) 843-5413

CHESTER LLOYD JONES
THOMAS M. GAA

December 15, 1980

Mr. Arthur D. Taylor
Dam Safety Engineer
Dept. of Natural Resources
32 South Ewing
Helena, Montana 59601

File: Rick Henderson

Dear Mr. Taylor:

Your letter of November 19, 1980 sending to Richard L. Henderson of Ennis, Montana a draft concerning the inspection of the so-called "Hacker Dam" has been referred to me for answer.

Mr. Henderson wishes me to convey to you the fact that he has, in regard to the dam, requested assistance and has received assistance from the Soil Conservation Service in connection with this dam and has in all respects implemented their recommendations including the cleaning of the area to avoid the accumulation of trash in the overflow facility.

He notes with pleasure the classification of the dam as a low risk project and he will continue to operate the facility with due regard to public safety.

Yours very truly,

CHESTER LLOYD JONES

CLJ/vkb
cc Richard L. Henderson